

INSTITUTE AND FACULTY OF ACTUARIES



EXAMINATION

19 April 2018 (pm)

Subject ST9 – Enterprise Risk Management

Time allowed: Three hours

INSTRUCTIONS TO THE CANDIDATE

1. *Enter all the candidate and examination details as requested on the front of your answer booklet.*
2. *You must not start writing your answers in the booklet until instructed to do so by the supervisor.*
3. *You have 15 minutes of planning and reading time before the start of this examination. You may make separate notes or write on the exam paper but not in your answer booklet. Calculators are not to be used during the reading time. You will then have three hours to complete the paper.*
4. *Mark allocations are shown in brackets.*
5. *Attempt all three questions, beginning your answer to each question on a new page.*
6. *Candidates should show calculations where this is appropriate.*

AT THE END OF THE EXAMINATION

Hand in BOTH your answer booklet, with any additional sheets firmly attached, and this question paper.

In addition to this paper you should have available the 2002 edition of the Formulae and Tables and your own electronic calculator from the approved list.

- 1** BB is a national chain of takeaway food shops which sells fast food and soft drinks. It operates on a franchise basis, i.e. each branch pays BB for a license to use the BB brand, but the branch is owned and run by an individual. Profit in each franchise is shared between the franchise and BB. BB, therefore, has an interest in managing the risks within each franchise.

BB insists that all branches measure operational risks using expected shortfall over a one month time horizon, and report the results back to the BB head office. It defines expected shortfall as the probability of loss multiplied by the expected loss given that a loss has occurred.

- (i) State the four main sources of operational risk for any organisation. [2]
- (ii) Comment on the use of expected shortfall as a risk metric in general. [3]
- (iii) Explain why a one month time horizon may not be appropriate for this operational risk metric in relation to BB. [3]

BB expects all franchise owners to calculate their own expected shortfall for their top five operational risks. BB provides a list of standard operational risks and tables of associated probability distributions for the probability of loss. The individual franchises may or may not decide to use these tables.

- (iv) Assess the suitability of this approach. [4]

The operational risk capital for each franchise is calculated as the sum of the risk capital required for each of the top five operational risks for that franchise. An additional 25% is added to the total to allow for the remaining operational risks.

- (v) Discuss the advantages and disadvantages of this approach to calculating operational risk capital. [4]

BB's operational risk manager looks at previous operational risk events impacting BB and suggests that operational risk events are not independent. The operational risk manager wants to apply a correlation coefficient during the aggregation of operational risks.

- (vi) Assess the suitability of Pearson's rho as a correlation measure in this instance. [5]

The risk management function of BB is outsourced to a consultancy, which has allocated four people to BB for six months every year. For the other six months of the year, there is no team looking after BB. The team consists of one operational risk manager, one market risk manager, one credit risk manager and one overall project manager.

The quantification and reporting of risks other than operational risks is carried out annually by this risk function. All risk reporting is done to the compliance manager of BB Group, who is not a board member. The risk function sets the risk appetite at the risk category level (that is: operational risk, market risk and credit risk). Breaches are identified during the annual quantification process and presented in the annual risk report.

- (vii) Propose actions that BB can take to improve the effectiveness of its risk management function. [6]

The risk management function has set a risk limit for operational risk: that expected shortfall must not exceed \$5m for any single franchise. The expected shortfall for one particular franchise is currently \$7.5m.

- (viii) Recommend three distinct actions which the owner of that franchise could take in order to bring operational risk within the risk limit. [3]

- (ix) Outline the main downsides of the actions recommended in part (viii). [3]

The National Food Authority (NFA) is the food industry regulator that issues licenses for all food-related businesses. One of the risks in BB's annual risk report is the risk of its licence not being renewed by the NFA. This risk has increased since the previous report.

The risk management function has therefore recommended managing the regulator relationship in order to reduce this risk, and has decided to introduce a Regulatory Engagement Policy.

- (x) Outline items that should be included in this Policy. [6]
[Total 39]

- 2** OldCo is a medium-sized company. It is the sponsoring employer to the OldCo pension scheme, which is a defined benefit arrangement. A defined benefit pension scheme is one which pays members a defined amount of pension income benefit each year.

The pension scheme's liabilities, which are equal to the present value of the expected future pension payments from the scheme, are several times the current market value of the company. The OldCo pension scheme is in deficit – that is, its assets are less than its liabilities. The pension scheme is invested in a range of domestic government bonds, domestic corporate bonds and global equities.

The pension scheme is governed by a board of trustees, who are independent of the company. The trustees are concerned that the sponsoring employer may become insolvent, and that pension scheme members' benefits may need to be reduced. To mitigate this risk, the trustees are considering entering into a credit default swap (CDS) with an investment bank, based on bonds issued by OldCo.

- (i) State the two methods by which a CDS can be settled. [1]
- (ii) Draw, for each of these two methods, a diagram showing the cash flows that arise under the CDS. [4]
- (iii) Outline the residual risks that would remain (including additional risks that would arise) if a CDS were to be used. [5]

The trustees decide not to use a CDS. Instead, they decide to try to understand better the range of risks to which the scheme is exposed, and the level of risk that they regard as acceptable. Below is an extract from the minutes of the most recent trustee meeting:

The trustees discussed asset allocation. They agreed that whilst they want to match the assets to the liabilities, it is important to hold some return-producing assets to help to reduce the deficit. They are comfortable with an allocation to equities of up to 30% of total assets, of which up to one-third could be in emerging market equities. They are also comfortable having up to 20% of assets invested in real estate (property or land). The trustees are not comfortable using derivatives.

The trustees then discussed the scheme's funding. They agreed that the aim of the scheme should be to be comfortably over-funded – that is, assets greater than liabilities – in ten years' time. This is so that there will be some spare assets to allow for future uncertainty. The target level of funding (i.e. ratio of assets to liabilities) in ten years is 110%. The trustees also want to make sure that contributions from the sponsoring employer are sufficient to limit the chance of being under-funded in ten years' time to 5%.

The trustees acknowledge that, as the scheme is maturing, cash flow is increasingly important. They want to ensure that the projected cash flow over any month is at least 10% higher than the projected liabilities payable over the same period, and that the projected cash flow over any twelve-month period is at least 20% higher than the projected liabilities payable over the same period.

The trustees recognise that it is difficult to completely eliminate administrative errors. However, they would like to see no more than 20 minor administration errors occur in any twelve-month period, and no major administration errors.

- (iv) Set out, using the extract above, the desired risk profile of the trustees for the OldCo scheme, including appropriate risk metrics where relevant. [5]
- (v) Suggest other factors that the trustees could consider when drafting the desired risk profile. [7]

The pensions regulator is considering requiring pension schemes to use an economic capital approach to determine the type and amount of assets that pension schemes should hold to meet their future liabilities.

- (vi) Describe the key features that measures of economic capital typically include. [3]
- [Total 25]

- 3 TreeSure is a specialist insurance company based in the south-east of a small country. It provides insurance cover to owners of large and valuable trees. The insurance policies are sold through a chain of tree nurseries which are also based in the south-east of the country.

A claim on a policy can be made if a tree is destroyed, or if it needs to be destroyed due to either bad weather or disease. Bad weather claims are almost always due to high winds, although a small number of losses have been attributed to floods and frost. TreeSure does not currently underwrite a new risk before providing insurance cover for that risk.

TreeSure offers two types of insurance policy:

- The “Compensation Policy” makes a cash payment that is intended to cover the cost of removing the old tree, the cost of a comparable new tree, and the cost of planting the new tree.
- The “Replacement Policy” commits to actually removing the old tree and planting a comparable new tree; no cash payment is made.

For a given risk and level of cover, the premium for a Replacement Policy is priced to be 10% lower than the equivalent premium for the Compensation Policy.

TreeSure aims to match its liabilities with a mix of domestic and non-domestic corporate bonds, together with direct lending to local businesses. Its free assets (i.e. the surplus of its assets over its liabilities) are invested in domestic equities.

- (i) Describe the risks to which TreeSure is exposed. [10]
- (ii) Suggest ways in which these risks could be mitigated. [10]
- (iii) Suggest two possible reasons for the price difference between the Replacement Policy and the Compensation Policy. [2]

The management of TreeSure has been carrying out analysis of the claims on its two policy types. Of 1,000 policies sold, 300 were Replacement Policies and 700 were Compensation Policies. From the Replacement Policies there were 30 claims, whilst from the Compensation Policies there were 140 claims.

- (iv) Comment on these results. [4]
- (v) Propose three distinct actions that TreeSure might take in the light of these results, other than introducing underwriting. [3]

The management of TreeSure ultimately decides to introduce underwriting to both the Replacement Policies and the Compensation Policies. One year after this change, 1,000 applications for insurance are analysed. Of the 1,000 applications, 400 are for Replacement Policies and 600 are for Compensation Policies. Of the 400 Replacement Policy quotes, 300 applicants take out a policy and 30 ultimately claim. Of the 600 Compensation Policy quotes, 200 applicants take out a policy and 25 ultimately claim. No applications were rejected

(vi) Comment on these results. [3]

TreeSure uses a model to estimate losses due to high winds. TreeSure has been recording maximum wind speed data (i.e. the maximum wind speed observed in each calendar year) for 70 years.

Significantly higher losses occur if the maximum wind speed exceeds 100 miles per hour. According to TreeSure's records, this has happened three times in the past 70 years.

Projections of wind speed are currently carried out by fitting the maximum wind speed in each year to a lognormal distribution.

(vii) Comment on the approach currently used to model very high wind speeds. [3]

(viii) Propose an alternative approach that might better model the risk of very high wind speeds. [1]
[Total 36]

END OF PAPER